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(54) A packaging laminate and a method of producing the same.

(57) A packaging laminate (10) including a rigid, but foldable paper or paperboard layer (11) which has, at least on its one side, an outer film or coating (12) of a water-insoluble polysaccharide compound which imparts to the packaging laminate (10) tightness properties against liquid and water vapour and good sealing properties. Preferably, the other side of the core layer (11) also has an outer film or coating (13) of said polysaccharide compound.

The polysaccharide compound in the two outer films or coatings (12 and 13) includes, on the one hand, a first water-soluble polysaccharide of polyanionic character and, on the other hand, a second water-soluble polysaccharide of polycationic character, these being chemically or otherwise bonded to one another for forming the water-insoluble polysaccharide compound. One preferred such polysaccharide compound may, for example, consist of a chemical compound or a chemical complex of chitosan and agar.

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TECHNICAL FIELD

The present invention relates to a packaging laminate including a core layer, and a film or coating possessing good sealing properties and low water vapour permeability applied to one or both sides of the core layer. The present invention also relates to a method of producing the packaging laminate.

BACKGROUND ART

Nowadays, packaging containers of the single-use disposable type are often employed for packing and transporting foods of a liquid nature, such as milk. The material in these so-called single-use packages is normally composed of a plurality of mutually laminated layers of the same or different materials which, in cooperation with one another, impart the desired mechanical and chemical properties to the package.

A well-known packaging laminate which has long been employed in the art for this type of package consists, for example, of one or more inner layers of a fibre material, which gives the package the requisite mechanical strength and configurational stability, and outer layers of plastics which give the package its necessary tightness properties against liquids which could otherwise readily penetrate into the fibre layers of the packaging material and thereby weaken the mechanical strength and bond properties of the package. Preferably, the outer plastics layer of the packaging laminate consists of thermoplastic, ideally polyethylene, which is impermeable to liquid and moisture and which, moreover, makes the packaging laminate heat-sealable or fusible in such a manner that mutually facing plastics layers of the packaging laminate may readily be united to one another by surface fusion for the formation of mechanically strong, liquid-tight sealing joints or seams during the packaging production process.

Thus, from a web of the above-described prior art packaging laminate, there are produced configurationally stable, liquid-tight single use packages employing modern, rational packaging machines which reform the web into a tube, in that the two longitudinal edges of the web are brought to overlap one another and are fused to one another in a longitudinal lap joint or seam. The tube is filled with the desired contents and then divided into closed, cushion-shaped packages by repeated transverse sealings of the tube, transversely of the longitudinal axis of the tube, beneath the level of the contents in the tube. The packages are separated from one another by incisions in the transverse sealing zones and are given the desired geometric, normally parallelepipedic, final form by a subsequent forming and sealing operation.

Even if a packaging laminate of the above-outlined type with outer layers of thermoplastic functions satisfactorily in several respects, it nevertheless suffers from numerous serious drawbacks. Thermoplastics, for example polyethylene, are extracted from oil which is a non-renewable natural resource and consequently runs the long-term risk of becoming exhausted, at the same time as it is, at present, difficult (and in many cases impossible) to recover and recycle the thermoplastic in spent packaging laminates and used packages. Further, thermoplastics are plastics which are biologically difficult to degrade and, in order to counteract the growth of the much debated "refuse mountain", it is often necessary to incinerate the used packaging material, with other consequential environmental problems.

OUTLINE OF THE INVENTION

One object of the present invention is therefore to realise a packaging laminate of the type described by way of introduction without those problems and drawbacks from which the prior art technology suffers.

This object is attained according to the present invention by means of the packaging laminate as defined in appended Claim 1.

According to the present invention, it has surprisingly proved possible to produce and use for packaging purposes a film or a coating of a polysaccharide compound which, without being linked to any scientifically verified theory, is assumed to be a chemical product or chemical complex of a first water-soluble polysaccharide of cationic character and a second water-soluble polysaccharide of anionic character which, by chemical or other form of bonding, unite with one another for the formation of the water-insoluble polysaccharide compound. Likewise, it has surprisingly proved that such a film or coating possesses excellent tightness properties against liquid and moisture, in particular low water vapour permeability, at the same time as the film or coating, respectively, possesses superior heat sealing properties and is, therefore, easy to heat seal or fuse by conventional heat-sealing techniques.

What is particularly advantageous is that both the first and the second polysaccharides occur in nature and are easy to extract from biological raw materials sources which are renewable and, consequently, do not run the risk of becoming exhausted.

In one preferred embodiment of the present invention, the first, water-soluble polysaccharide consists of chitosan which occurs in abundance and is easy to extract from the shells of marine

crustaceans such as crabs. In its natural environment, chitosan is electrically neutral but can, by known techniques (the deacetylation method) in an alkaline environment, be given the character of a polycation. This technique is based on the concept of replacing ring-bonded acetyl groups

$$(-\ddot{C}\text{-}CH_3)$$

with ammonium groups ($-NH_3^+$) which are assumed to be those active groups to which the second water-soluble polysaccharide bonds on production of the water-insoluble polysaccharide compound according to the invention. The degree of deacetylation, i.e. the proportion of replaced acetyl groups of the total number of acetyl groups of the thus activated chitosan polysaccharide can vary within broad limits, but should be in excess of 10% in order to give a sufficient number of active groups available for reaction with the second polysaccharide.

The second water-soluble polysaccharide is, according to the present invention, selected from the group essentially comprising agar, alginate, pectin, karrageenan, starch, modified starch, cellulose and derivates thereof. By preference, agar is selected.

Further advantageous embodiments of the packaging laminate according to the present invention have moreover been given the characterizing features as set forth in appended subclaims 2 to 6.

A further object of the present invention is to realise a method of producing the packaging laminate according to the invention.

This object is attained by the method as defined in independent Claims 6 and 9.

Further expedient and advantageous embodiments of the method according to the present invention have moreover been given the characterizing features as set forth in appended subclaims 8 to 9 and 10 to 13, respectively.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The present invention will now be described and explained in greater detail hereinbelow, with particular reference to the accompanying Drawings. In the accompanying Drawings:

Fig. 1 schematically illustrates a cross section of a packaging laminate according to one preferred embodiment of the present invention;

Fig. 2 schematically illuminates a method of producing a packaging laminate according to the present invention; and

Fig. 3 schematically illuminates an alternative method of producing a packaging laminate according to the present invention.

DESCRIPTION OF PREFERRED EMBODIMENT

The packaging laminate according to the invention illustrated in Fig. 1 has been given the generic reference numeral 10. The packaging laminate 10 includes a rigid, but foldable core layer 11 of paper or paperboard which, on its one side, has an outer film or coating 12 of a water-insoluble polysaccharide compound bonded to the core layer 11. In the illustrated embodiment, the outer polysaccharide film or coating 12 is disposed against that side of the core layer 11 which is intended to be turned to face inwardly in a packaging container produced from the packaging laminate 10, for direct contact with the contents of the packaging container. As illustrated in Fig. 1, the packaging laminate 10 preferably also has an outer film or coating 13 of a polysaccharide compound on the other side of the core layer 11 which, thus, is intended to form the outside of the packaging container. Since the films or coatings 12 and 13 both consist of a water-insoluble polysaccharide compound with superior tightness properties against both liquid and water vapour, the one outer film or coating 12 affords to the inner core layer 11 of the packaging laminate 10 good protection against the penetration of liquid and other moisture from the contents of the packaging container, at the same time as the second, outer film or coating 13 efficiently protects the core layer 11 against exterior moisture which may occur in the ambient surroundings of the container.

As has been mentioned previously, the polysaccharide compound in the outer films or coatings 12 and 13 consists, on the one hand, of a first water-soluble polysaccharide (A) and, on the other hand, a second water-soluble polysaccharide (B) which together, by chemical or other bonding between active cation groups in the first polysaccharide and active anion groups in the second polysaccharide, form the water-insoluble, liquid and water-vapour proof, heat-sealable polysaccharide compound.

The first water-soluble polysaccharide (A) preferably consists of chitosan which is a polysaccharide extracted from, for example, crabs and similar marine crustaceans, and which, by known deacetylation techniques, has been given the character of a polycation in that some or all of the ring-bonded acetyl groups in the chitosan polysaccharide have been replaced by ammonium groups. The degree of deacetylation of the chitosan polysaccharide may vary over a broad range, but should be in excess of 10% in order to give a sufficient number of active cation groups for reaction with correspondingly active anion groups in the second polysaccharide (B).

The second water-soluble polysaccharide (B) may be selected from among agar, alignate, pectin, karrageenan, starch, modified starch, cellulose and derivates thereof, preferably agar. Agar (which can readily be extracted from, for instance, marine algae) is commercially available and displays anion groups available for bonding to the cation groups of the chitosan polysaccharide in the form of sulphon groups (SO_3-).

In the preferred embodiment of the present invention, the polysaccharide compound thus consists, in both of the outer films or coatings 12 and 13 of the packaging laminate, of a water-insoluble polysaccharide compound of chitosan and agar in which the above-mentioned cation groups in the chitosan polysaccharide are chemically or otherwise bonded to the above-mentioned anion groups in the agar polysaccharide.

The thickness of the outer polysaccharide films or coatings 12 and 13 of the packaging laminate 10 may vary, but is preferably of the order of magnitude of between 5 and 15 µm each, which gives to the packaging laminate 10 its requisite tightness properties and heat-sealable (fusible) properties. Thicknesses within the above range correspond to surface weights of between 5 and 15 g/m^2.

According to the invention, the packaging laminate 10 in Fig. 1 can be produced either by a coating operation which is schematically illustrated in Fig. 2, or by a lamination operation which is schematically illustrated in Fig. 3.

According to Fig. 2, the packaging laminate is produced in that an aqueous solution of the first water-soluble polysaccharide (A) and the second water-soluble polysaccharide (B) are first prepared, and thereafter (at 24) the aqueous solution is applied to one or both sides of a web 21 of paper or board which finally (at 25) is dried for driving off water, for the formation of water-insoluble polysaccharide coatings 22 and 23, respectively.

In one concrete embodiment employing chitosan as first polysaccharide (A) and agar as second polysaccharide (B), the procedure may be as follows: 4% by weight of chitosan is dissolved in cold, acidified (pH<6,5) water for forming a first aqueous solution, and 4% by weight of agar is dissolved or slurried in cold water and boiled for forming a second aqueous solution. The two aqueous solutions are mixed together in such a mixing ratio that the thus obtained aqueous solution contains between 1 and 80% by weight of chitosan, and the mixture is heated to 60-70 °C. The thus heated aqueous solution is applied in liquid form to one or both sides of the web in a continuous, blanketing layer in such a quantity that the applied layer, after driving off of water, has a thickness of between 5 and 15 µm (corresponding to a surface weight of between 5 and 15 g/m^2).

According to Fig. 3, the packaging laminate according to the invention is produced by lamination of a web 31 of paper or board with two prefabricated films (32 and 33) of the water-insoluble polysaccharide compound which preferably consists of a chemical compound or a chemical complex of chitosan and agar. The web 31 is brought together with the two prefabricated films, at the same time as hot water 34 or steam is fed in between the web and each respective film, whereby the polysaccharide film is activated and permanently bonded under pressure to the web. The prefabricated polysaccharide films have, in this example, a thickness of between 5 and 15 µm each (corresponding to a surface weight of between 5 and 15 g/m^2).

As is apparent from the foregoing description, there will be realised in a simple manner and by simple means, a packaging laminate of the type described by way of introduction which possesses excellent tightness and sealing properties, without consequential problems and drawbacks of the type from which the prior art technique suffers.

The packaging laminate according to the invention is an environmentally advantageous and valuable material, since it substantially consists only of naturally occurring materials and, thus, does not add environmentally foreign matter to nature.

Even though the present invention has been described and explained with particular reference to specific embodiments and selection of starting materials and dimensions, it will be obvious to a person skilled in the art that modifications are possible within the scope of the inventive concept. Such modifications thus lie within the spirit and scope of the present invention as defined in the appended Claims. For example, it is possible without departing from the spirit and scope of the present invention, to supplement the described packaging laminate with one or more additional layers of material of the same or other type than those mentioned and described herein.

Claims

1. A packaging laminate including a core layer, and a film or coating possessing good sealing properties and low water vapour permeability applied to one or both sides of the core layer, **characterized in that** the film or coating, respectively consists of a polysaccharide compound which includes a first water-soluble polysaccharide (A) and a second water-soluble polysaccharide (B) but which in itself is insoluble in water.

2. The packaging laminate as claimed in Claim 1, **characterized in that** the first polysaccharide

(A) consists of at least partly deacetylated chitosan.

3. The packaging laminate as claimed in Claim 2, **characterized in that** said chitosan has a degree of deacetylation of at least 10%.

4. The packaging laminate as claimed in any one of the preceding Claims, **characterized in that** the second polysaccharide (B) is selected from among agar, alginate, pectin, karrageenan, starch, cellulose and derivates thereof.

5. The packaging laminate as claimed in any one of the preceding Claims, **characterized in that** the film or coating, respectively, has a thickness of between 5 and 15 µm, corresponding to a surface weight of between 5 and 15 g/m^2.

6. The packaging laminate as claimed in any one of the preceding Claims, **characterized in that** the core layer consists of paper or paperboard.

7. A method of producing a packaging laminate as claimed in any one of the preceding Claims, **characterized in that** one or both sides of a continuous web are coated with an aqueous solution containing a first polysaccharide (A), and a second polysaccharide (B); **and that** the web is thereafter dried for driving off water, for the formation of the water-insoluble polysaccharide coating.

8. The method as claimed in Claim 7, **characterized in that** the first polysaccharide (A) consists of at least partly deacetylated chitosan.

9. The method as claimed in Claim 7 or 8, **characterized in that** the second polysaccharide (B) is selected from among agar, alginate, pectin, karrageenan, starch, cellulose and derivates thereof.

10. A method of producing a packaging laminate as claimed in any one of Claims 1 to 6, **characterized in that** one or both sides of a continuous web are laminated with a prefabricated film of a polysaccharide compound which includes a first water-soluble polysaccharide (A), and a second water-soluble poysaccharide (B), but which in itself is insoluble in water.

11. The method as claimed in Claim 10, **characterized in that** the first polysaccharide (A) consists of at least partly deacetylated chitosan.

12. The method as claimed in Claim 10 or 11, **characterized in that** the second polysaccharide (B) is selected from among agar, alginate, pectin, karrageenan, starch, cellulose and derivates thereof.

13. The method as claimed in any one of Claims 10 to 12, **characterized in that** the web and the prefabricated film are bonded to one another by means of hot water or steam which is fed in between the web and the prefabricated film.

Fig.1

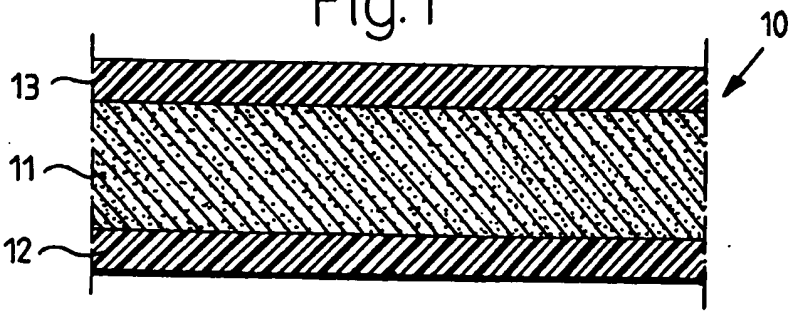

Fig.2

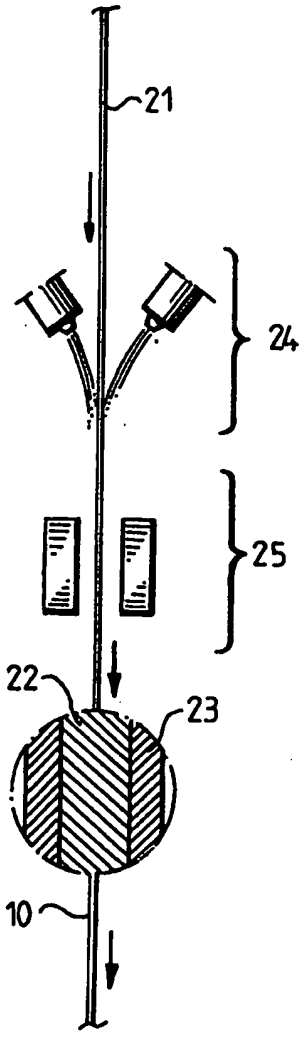

Fig.3